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[NECESSITY OF PROOF] Necessary

[DOCUMENT] Description

[TITLE OF THE INVENTION]

INK JET RECORDING APPARATUS

[PATENT CLAIM]

[Claim 1]

An ink jet recording apparatus comprising:

a recording head for jetting a photo curable ink to a recording medium, from a plurality of jet openings arranged in row;

a plurality of light source for emitting light to cure an ink jetted from the recording head;

a light quantity measuring sensor for measuring a light quantity of the light source;

a memory section for storing a desired value of light quantity of the light source; and

a control section for controlling the light quantity of the light source according to a measured value by the light quantity measuring section and the desired value of light quantity of the light source stored in the memory section;

wherein in case at least one of the measured value of the light source is less than a desired value of the light source, the control section increases a light quantity of another light source which is different from the light source.

[Claim 2]

The ink jet recording apparatus of claim 1, wherein the control section increases the light quantity of the light source that is proximity to the light source.

[Claim 3]

The ink jet recording apparatus of claim 1 or 2, further comprising a light source scanning mechanism to scan the plurality of light sources to make it face the light quantity measuring sensor.

[Claim 4]

The ink jet recording apparatus of claim 3 wherein the light source scanning mechanism scans the recording head.

[Claim 5]

The ink jet recording apparatus of any one of claims 1 to 4 further comprising a sensor scanning mechanism to scan the light quantity measuring sensor to make it face each of the plurality of light sources.

[Claim 6]

The ink jet recording apparatus of any one of the claims 1 to 5 further comprising an informing section to inform the worker a comparison result of the desired value with the measured value, wherein in case the measured value is less than the desired value, the control section informs the result for comparing to the informing section.

[Claim 7]

The ink jet recording apparatus of any one of the claims 1 to 6, wherein the ink is cured by irradiating ultraviolet-ray.

[Claim 8]

The ink jet recording apparatus of any one of the claims 1 to 7, wherein a cationic polymerization ink is used as the ink.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Industrial Field of the Invention]

The invention relates to an ink jet recording apparatus in which photo-curable ink is used.

[0002]

[Conventional Art]

Generally, in an ink jet recording apparatus, noise during printing is relatively small and the print quality is good, so that it has been widely used.

The ink jet recording apparatus jets fine ink droplets from nozzles of the recording head toward a recording medium such as a paper by using, for example, piezoelectric elements, heater elements or the like, and moves a relative position of the recording head and the recording medium while making ink penetrate the recording medium or fixing ink on the recording medium so as to form an image on the recording medium.

There are, for example, a serial head type and a line head type ink jet recording apparatuses. In the serial head type, a recording head reciprocates on the recording medium and the recording medium is carried in a direction perpendicular to a scanning direction of the recording head for forming an image. In the line head type, a recording head which has a nozzle line having a recording range width for the recording medium is fixed, and an image is formed by carrying the recording medium perpendicular to a width direction of the recording medium.

[0003]

Recently, in a field of printing on goods or packing material for goods, demand for a small-lot production have been increasing, so that the ink jet method in which a small-lot production can be achieved at low cost in comparison with the method such as a gravure printing method or a flexographic method which needs a plate making has been used.

As is well known, material with less ink absorptivity such as resin or metal is quite often used for goods or packing material for goods.

For enabling the ink to be fixed on the recording medium when such the material with less absoptivity is used as a recording medium, an ink jet recording apparatus of photo curable type in which the photo curable ink with high viscosity is irradiated with light such as ultraviolet-rays

(UV-rays) after the ink was jetted and attached to the recording medium to cure and fix the ink on the recording medium has been developed.

[0004]

Earlier, as the ink jet recording apparatus of the photo curable type, an ink jet recording apparatus of an ultraviolet curable type has been put to practical use, in which radical polymerization ink is used and a great deal of UV-rays is radiated all at once. (see, for example, Patent Document 1).

[0005]

[Patent Document 1]

Japanese Patent Publication Tokukai-hei 2001-310454 (4pages)

[0006]

[Problem to be solved according to the Invention]

However, when radical polymerization ink is used, relatively a great deal of UV irradiation is required. Thus, a high-power light source is to be mounted, thereby causing the apparatus to become large and raise the cost of production.

To solve the problem, it is considered to use cationic polymerization ink which has not been put to practical use. However, cationic polymerization ink has a unstable property such as a humidity dependency and a property to cause curing reaction with weak light such as

reflection light or the like, so that it is hard to handle and difficult to put into practical use.

For example, degradation of a light source by long-term use lowers lighting intensity to the ink, and decline of lighting intensity is caused by ink mist as the light source gets closer to the recording head by request of miniaturizing the apparatus and the like. Especially, when a plurality of light sources are used with respect to each recording head, the lighting intensity which is required for curing reaction is ensured by the plurality of light sources. However, when even only one of the light sources is degraded or affected by the ink mist to lower the light quantity, the lighting intensity which is required for curing reaction cannot be ensured. When the light quantity of a light source is lowered, maintenance is needed to be performed. However, when the plurality of light sources are used as described above, the timings of lowering the light quantity in each light source differ, so that number of maintenances are increased to increase the burden on workers.

[0007]

An object of the present invention is to decrease the burden on workers by decreasing number of maintenance.

[0008]

[Means for Solving the Problem]

In accordance with the present invention, the ink jet recording apparatus of the claim 1 comprises:

a recording head for jetting a photo curable ink to a recording medium, from a plurality of jet openings arranged in row;

a plurality of light source for emitting light to cure an ink jetted from the recording head;

a light quantity measuring sensor for measuring a light quantity of the light source;

a memory section for storing a desired value of light quantity of the light source; and

a control section for controlling the light quantity of the light source according to a measured value by the light quantity measuring section and the desired value of light quantity of the light source stored in the memory section

wherein in case at least one of the measured value of the light source is less than a desired value of the light source, the control section increases a light quantity of another light source which is different from the light source.

[0009]

According to claim 1 of the ink jet recording apparatus of the invention, in case at least one of the measured value measured by the light quantity measuring section is less than the desired value, the control section

increases the light quantity of the light source other than the light source that had the measured value less than the desired value. Therefore, even when a light quantity of a light source (first light source) decreases by degradation, ink mist or the like, the decrease of light quantity is supplemented by another light source (second light source), so that the lighting intensity enough to cause ink curing reaction can be achieved. When a light source having a light quantity less than the desired value thereof in other light sources appears while carrying out image formation, the lighting intensity enough to cause ink curing reaction can be achieved by increasing a light quantity of a light source in the remaining light sources again. When the lighting intensity enough to cause ink curing reaction cannot be achieved because the number of light sources having a light quantity less than the desired value thereof increases, workers carry out maintenance such as removing the ink which is the cause of the decrease of light intensity or exchanging the degraded light source. The number of maintenances can be decreased by adjusting the timing of each maintenance, thereby reducing the load on workers.

[0010]

In accordance with the invention of the claim 2, the ink jet recording apparatus of claim 1 the control section

that increases the light quantity of the light source that is proximity to the light source.

[0011]

According to claim 2 of the ink jet recording apparatus of the invention, since the light quantity of the light source that is proximity to the light source is increased, a portion which was to be irradiated with light by the light source having a light quantity less than the desired value thereof can be irradiated with light without delay. Therefore, difference in dot diameters can be prevented to stabilize an image.

[0012]

In accordance with the invention of the claim 2, the ink jet recording apparatus of claim 1 or 2 comprises a light source scanning mechanism to scan the plurality of light sources to make it face the light quantity measuring sensor.

[0013]

According to the invention of claim 3, since the light source scanning mechanism scans the plurality of light sources to make it face the light quantity measuring sensor, light quantity of all the light sources can be measured even when the number of light quantity measuring sensor is less than the light source. since the different light sources are measured by the same light quantity measuring sensor 3, the number of the light quantity measuring sensor

3 can be less than that of the light sources 8, and the apparatus can be simplified and miniaturized.

[0014]

In accordance with the invention of the claim 4, the light source scanning mechanism of the ink jet recording apparatus of claim 3 comprises scans the recording head.

[0015]

According to the invention of claim 4, since the light source scanning mechanism scans the recording head, the recording head and the light source can be combined. Therefore, the apparatus itself can be downsized.

[0016]

In accordance with the invention of claim 5, the ink jet recording apparatus of any one of the claims 1 to 4 further comprises a sensor scanning mechanism to scan the light quantity measuring sensor to make it face each of the plurality of light sources.

[0017]

According to the invention of claim 5, since the sensor scanning mechanism scans the light quantity measuring sensor to make it face each of the plurality of light sources, even when the light source is not scanned, as an ink jet recording apparatus with line print method applied for example, light quantity of every light source can be measured.

[0018]

In accordance with the invention of claim 6, the ink jet recording apparatus of any one of the claims 1 to 5 further comprises an informing section to inform the worker a comparison result of the desired value with the measured value, wherein in case the measured value is less than the desired value, the control section informs the result for comparing to the informing section.

[0019]

According to the invention of claim 6, since the control section informs the comparison result to the informing section in case the measured value is less than the desired value, it is capable to let the worker be informed that maintenance is needed in the near future. Therefore, it is possible to make the necessary preparations for maintenance before the timing of maintenance so as to effectively perform maintenance.

[0020]

In accordance with the invention of claim 7, the ink jet recording apparatus of any one of the claims 1 to 6, has the ink cured by irradiating ultraviolet-ray.

[0021]

According to the invention of claim 7, since the light source that irradiates ultraviolet-ray is used to cure the ink, curability can be improved and cost can be decreased, compared to light sources that irradiate other light.

[0022]

In accordance with the invention of claim 8, the ink jet recording apparatus of any one of the claims 1 to 7 uses a cationic polymerization ink as the ink.

[0023]

According to the invention of claim 8, even when the cationic polymerization ink is jetted, it is capable to prevent the image being inhomogeneous according to the type of the recording media.

[0024]

[Embodiment of the Invention]

Hereinafter, an embodiment of the invention will be explained with reference to FIGS. 1 to 8. FIG. 1 is a view showing a structure of an ink jet recording apparatus 1 of the present embodiment.

[0025]

The ink jet recording apparatus 1 is an ink jet recording apparatus of serial head type, in which the recording head is scanned in a direction perpendicular to a direction that recording medium is carried while an image is formed by a cationic polymerization ink. This ink jet recording apparatus 1 is provided with a platen 2 to support the recording medium from below, and above the platen 2, a carriage 3 that scans in a direction perpendicular to a direction that recording medium is carried is provided.

[0026]

The carriage 3 is provided with a plurality of recording heads 4, that jet out each color of the ink (Y: yellow, M: magenta, C: cyan, K: black). As shown in FIG. 2, on the jetting side 41 of the recording head 4, a plurality of jet openings 42 to jet out the ink are mounted in line in a direction identical to carrying direction of the recording medium.

In addition, carriage 3 is provided with a light irradiation device 5 that is lined one after another with the recording head 4 in the direction following the scanning direction, to cure the ink jetted on the recording medium. The light irradiation device 5 is provided with a plurality of dot light sources 51 in line parallel to the line of the jet openings 42 so as to correspond to each of the jet openings 42.

[0027]

Here, various light sources which radiate UV-rays, electron beams, X-rays, visible rays or infrared rays can be utilized as the light source 51, however, considering the curing property and the cost of light source, light source which radiates UV-rays is preferable. In particular, for example, a fluorescent lamp, a mercury lamp, a metal halide lamp, an LED, or a UV laser can be used.

[0028]

As shown in FIG. 1, on the side of platen 2, a light quantity measuring sensor 6 to measure the light quantity

of each of the light source 51 is provided so as to face the light irradiating device 5 of the carriage 3. That is, the carriage 3 functions as a light source scanning mechanism to scan the plurality of light sources to face the light quantity measuring sensor 6. The light quantity measuring sensor 6 is scanned in a direction identical to carrying direction of the recording medium (shown by arrow A) by a sensor scanning mechanism 8 (refer to FIG. 3) so as to measure light quantity of all the light source 51 mounted on the facing light irradiation device 5.

[0029]

As shown in FIG. 3, the ink jet recording device 1 is provided with a control section 7 to control each driving section. To the control section 7 is connected a monitor 71 to display various things, a memory section 72 to store control program and control data (desired value of each light source 51, for example), and controls various devices according to the control program and control data stored in the memory section 72.

To the control section 7, carrying mechanism 9 for recording medium, driving source 31 for the carriage 3, sensor scanning mechanism 8, recording head 4, light source 51, and light quantity measuring sensor 6 are electrically connected. In addition, various driving section of the ink jet recording device 1 other than the mentioned above are connected to control section 7.

[0030]

Next, an operation of the ink jet recording apparatus 1 in the embodiment at the time of inspecting the light sources will be explained referring to FIGS. 1-4. FIG. 4 is a flow chart showing the control procedure.

[0031]

First of all, the control section 7, within the instruction of image forming, moves the carriage 3 to a place where a first light irradiation device 5 faces the light quantity measuring sensor 6, and starts to measure the light quantity of each light source 51 (step S0).

The control section 7, by controlling the sensor scanning mechanism 8, makes a first light source 51 loaded on the first light irradiation device 5 face the light quantity measuring sensor 6, and lights the first light source 51. Within this step, the light quantity measuring sensor 6 measures a light quantity of the light source 51 (step S1), and the control section 7 stores a measured value inputted from the light quantity measuring sensor 6 into the memory section 72 (step S2). The control section 7 makes each light source 51 face the light quantity measuring sensor 6 by controlling the sensor scanning mechanism 8 until all of the light source loaded on the light irradiation device 5 is measured its light quantity, thus repeats step S1 and step S2 (step S3).

[0032]

When measuring light quantity of all the light source 51 of the first light irradiation device 5 is completed, the control section 7 compares the desired amount of light quantity and the measured value for each of the light source 51, by reading them out from the memory section 72 (step S4). Here, the desired amount of light quantity is set so as to meet a light amount required to cure ink, which is calculated according to effect property, an amount of the dropped ink droplets on the recording medium, and other conditions of cationic polymerization ink used, or obtained experimentally.

[0033]

Within this comparison, when at least one of the light source 51 has the measured value less than the desired amount of light quantity, the control section 7 determines whether the ink is curable by increasing light quantity of other light source 51, that is, a light source 51 that had a measured value larger than the desired amount of light quantity (step S5). When it is determined that the ink cannot be cured, there are a plurality of light sources 51 that needs maintenance, so the control section 7 displays a message indicating that maintenance is needed on monitor 71 (step S6), and stops image forming (step S7).

On the contrary, when it is determined that the ink can be cured, the control section 7 displays a message indicating that there is a light source 51 that has

measured value less than the desired amount of light quantity, on the monitor 71 (step S8), and determines light amount for each of the light source 51 that had measured value larger than the desired amount of light quantity (step S9). At this time, light amount for each of the light source 51 that had measured value larger than the desired amount of light quantity is increased so as to make up for an area where the light source 51 that has measured value less than the desired amount of light quantity were to irradiate, and cure ink dropped in that area. In order to prevent difference in dot diameters, for example, when light source 51a shown in FIG. 2 has measured value less than the desired amount of light quantity, it is preferable to have at least one of light sources 51b or 51c, that are the closest to the light source 51a, increase the light quantity. Preferably, the increased light quantity for light source 51b or light 51c is set so as the irradiation light quantity at a surface facing the light source 51a is equal or larger than the irradiation light quantity incase the surface facing the light source 51a is irradiated with the light source 51a with the desired amount of light quantity, and a predetermined coefficient according to profiles of light source 51a, 51b, and 51c. This is due to distribution in light intensity among area, and when light quantity is made up by light source 51b or 51c in case light quantity of light 51a decreased, in case it is

controlled merely to be the same light quantity, light quantity increases only at platen portion facing the light source 51b or 51c, and irradiation strength will not be enough at platen portion facing the light source 51a.

[0034]

When the control section 7 determines that all of the light source 51 loaded on the first light irradiation device 5 can irradiate with light quantity larger than the desired amount of light quantity in step S4, or determines light quantity for each light source 51 in step S9, aforementioned steps are repeated by controlling carriage 3 to make each light irradiation device 5 face the light quantity measuring sensor 6, until all of the light irradiation device 5 loaded on the carriage 3 is inspected. When inspection for all of the light irradiation device 5 are concluded, the control section 7 starts image forming.

[0035]

As mentioned above, according to the ink jet recording apparatus 1 of the present embodiment, when at least one of the light source 51 has the measured value less than the desired amount of light quantity, since the control section 7 increases light quantity of light source 51 other than the light source that had the measured value less than the desired amount of light quantity, light intensity required to cure ink can be maintained even in case when light quantity of the light source 51 decreases due to

degradation or ink mist, by making up for the decreased light quantity by other light source 51. In case another light source 51 that has measured value less than the desired amount of light quantity occurs from the other light source 51 during image forming, light quantity of a left light source 51 is once again increased to maintain the light intensity required to cure ink. When a number of light source that has measured value less than the desired amount of light quantity becomes large and light intensity required to cure ink cannot be maintained, a worker conducts maintenance such as removing ink causing decrease in light quantity, and replacing degraded light source. Therefore, by adjusting timing of each maintenance, number of maintenances can be decreased, thereby reducing the load on workers.

In addition, light can be irradiated to area where the light source 51 that has measured value less than the desired amount of light quantity were to irradiate without delay. Therefore, difference in dot diameters can be prevented to stabilize an image.

[0036]

Since carriage 3 scans a plurality of light source 51 to face the light quantity measuring sensor 6, light quantity of all the light sources can be measured even in case light quantity measuring sensor 6 is not provided as much as a number of light sources.

Since the carriage 3 scans the recording head 4, the recording head 4 and the light source 51 can be combined. Therefore, the apparatus itself can be downsized.

In addition, when a measured value less than the desired amount of light quantity is detected, the control section 7 informs monitor 71 the result for comparison and informs the worker that timing of maintenance timing is close. Therefore, preparation needed for maintenance can be arranged before hand, enabling efficient maintenance.

[0037]

Here, it is beyond controversy that present invention is not limited to aforementioned embodiment, and can be modified arbitrarily.

For example, in the present embodiment, ink jet recording apparatus 1 of a serial type has been described, however, the present invention can comprise of a line head type ink jet recording apparatus wherein a line head is used as a recording head. In case of the line head type ink jet recording apparatus, it is common to fix a plurality of light sources along the line head. Therefore, in order to measure the light quantity of each light source, light quantity measuring sensor is provided in a same number as the light source to face each light source, or light quantity measuring sensor in a number less than the light source is scanned along the light source by the sensor scanning mechanism to face each light source. When

some sort of member is placed between the light source and the light quantity measuring sensor (platen for example), the member is made of a material through which a light can pass through.

[0038]

In the present embodiment, a structure in which the record head 4 and the light irradiation device 5 is arranged one after another on the carriage 3 has been described. However, any arrangement that can irradiate the ink jetted on the recording medium from the record head 4 can be applied. For example, as shown in FIG. 5, a structure in which one light irradiation device 5A is arranged in a side of a plurality of record head 4 can be applied. In this case, a plurality of light sources is loaded on the light irradiation device 5A.

In the present embodiment, a structure in which light quantity for all of the light source 51 of a plurality of light irradiation device 5 is measured by one light quantity measuring sensor 6 has been described. However, as shown in FIG. 6, light quantity measuring sensors 6A, 6B, and 6C can be arranged so as to correspond each of the light irradiation device 5. Therefore, light quantity can be measured for each light irradiation device 5 at the same time, thus shortens time for measurement.

[0039]

In addition, in the present embodiment, a structure in which the light quantity measuring sensor 6 is scanned along the light source 51 on the side of platen 2 has been described. However, in case platen 2A is made of a material through which a light can pass through, as shown in FIG. 6, structure in which light quantity measuring sensors 6A, 6B, and 6C are scanned so as to face the light irradiation device 5 from beneath can be applied.

[0040]

In the present embodiment, a plurality of light source is loaded on the light irradiation device 5 in a direction perpendicular to a scanning direction, however, light source can be arranged in plural lines. For example, as shown in FIG. 7, a point-like light source 52 such as LED can be arranged on the light irradiation device 5 in two lines in a direction perpendicular to the scanning direction. In this case, when light source 52 has a light quantity less than the desired value of light quantity of the light source, in order to make up for the decreased light quantity of light source 52a, it is preferable to increase light quantity of at least one of the nearest light source, 52b, 52c, or 52d. Preferably, the increased light quantity for at least one of light sources 52b, 52c, or 52d is set so as the irradiation light quantity at a surface facing the light source 51a is equal or larger than the irradiation light quantity incase the surface facing

the light source 52a is irradiated with the light source 52a with the desired amount of light quantity, and a predetermined coefficient according to profiles of light source 52a, 52b, 52c, and 52d.

In addition, by increasing light quantity of jet opening 52b which is lined along a scanning direction of the light source 52a, dot diameter of ink jetted from jet opening 42a, which corresponds to light sources 52a and 52b, can be prevented from having a dot diameter different from other inks.

In case it is arranged in plural lines in a direction perpendicular to a scanning direction, it does not need to be a point-like light source, and a plurality of bar-like light source 53 such as a fluorescent tubes can be arranged as shown in FIG. 8. In case the bar-like light source 53 is used, light quantity of all the light source 53 can be measured without scanning the light quantity measuring sensor in the carrying direction.

In this case, when the light source 53a has light quantity less than a desired value of the light source, in order to make up for the decreased light quantity of light source 53a, it is preferable to increase light quantity of at least one of the nearest light source, 53b or 53c.

[0041]

In the present embodiment, as an informing section to inform the measured result, monitor 71 which gives visual

information has been described as an example. However, any apparatus that can give information to the worker can be used, such as a speaker, which gives auditory information.

[0042]

[Effect of the Invention]

According to the present invention of claim 1, light intensity required to cure ink can be maintained even in case when light quantity of the light source decreases due to degradation or ink mist, by making up for the decreased light quantity by other light source. In case another light source that has measured value less than the desired amount of light quantity occurs from the other light source during image forming, light quantity of a left light source is once again increased to maintain the light intensity required to cure ink. When a number of light source that has measured value less than the desired amount of light quantity becomes large and light intensity required to cure ink cannot be maintained, a worker conducts maintenance such as removing ink causing decrease in light quantity, and replacing degraded light source. Therefore, by adjusting timing of each maintenance, number of maintenances can be decreased, thereby reducing the load on workers.

[0043]

According to the present invention of claim 2, light can be irradiated to area where the light source that has

measured value less than the desired amount of light quantity were to irradiate without delay. Therefore, difference in dot diameters can be prevented to stabilize an image.

According to the present invention of claim 3, light quantity of all the light sources can be measured even in case light quantity measuring sensor is not provided as much as a number of light sources.

According to the present invention of claim 4, the recording head and the light source can be combined. Therefore, the apparatus itself can be downsized.

According to the present invention of claim 5, as with an image forming apparatus applied with a line print type for example, each of the light quantity can be measured even when the light source is not scanned.

[0044]

According to the present invention of claim 6, it is capable to inform the worker that timing of maintenance timing is close. Therefore, preparation needed for maintenance can be arranged before hand, enabling efficient maintenance.

According to the present invention of claim 7, since light source that irradiates ultraviolet-ray is used to cure the ink, curability can be improved and cost can be decreased, compared to light sources that irradiate other light.

According to the present invention of claim 8, even when the cationic polymerization ink is jetted, it is capable to prevent the image being inhomogeneous according to the type of the recording media.

[BREIF DESCRIPTION OF THE DRAWINGS]

[FIG. 1]

This is a side view showing an outline structure of an ink jet recording apparatus related to the present embodiment.

[FIG. 2]

This is a bottom view of a record head, a platen, a light irradiation device, and a light quantity measuring sensor provided on the ink jet recording apparatus shown in FIG. 1.

[FIG. 3]

This is a block diagram showing a main control part of the ink jet recording apparatus shown in FIG. 1.

[FIG. 4]

This is a flowchart showing control steps taken when control section of FIG. 3 conducts inspection.

[FIG. 5]

This is a side view showing an outline structure of a modified ink jet recording apparatus shown in FIG. 1.

[FIG. 6]

This is a bottom view of a record head, a platen, a light irradiation device, and a light quantity measuring

sensor, shown in FIG. 2, that are modification examples.

[Explanation of the Symbols]

1: ink jet recording apparatus

3: carriage (light source scanning mechanism)

4: record head

6: light quantity measuring sensor

7: control section

8: sensor scanning mechanism

42: jet openings

51: light source

71: monitor (informing section)

72: memory section

[DOCUMENT] Abstract

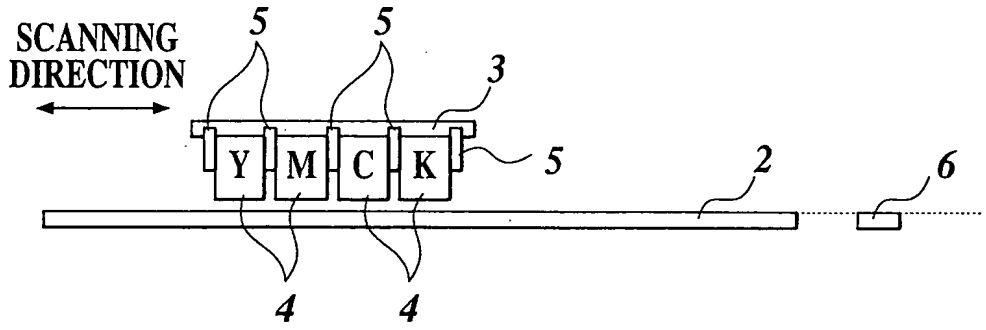
[ABSTRACT]

[OBJECT] An object is to decrease the burden on workers by decreasing number of maintenance.

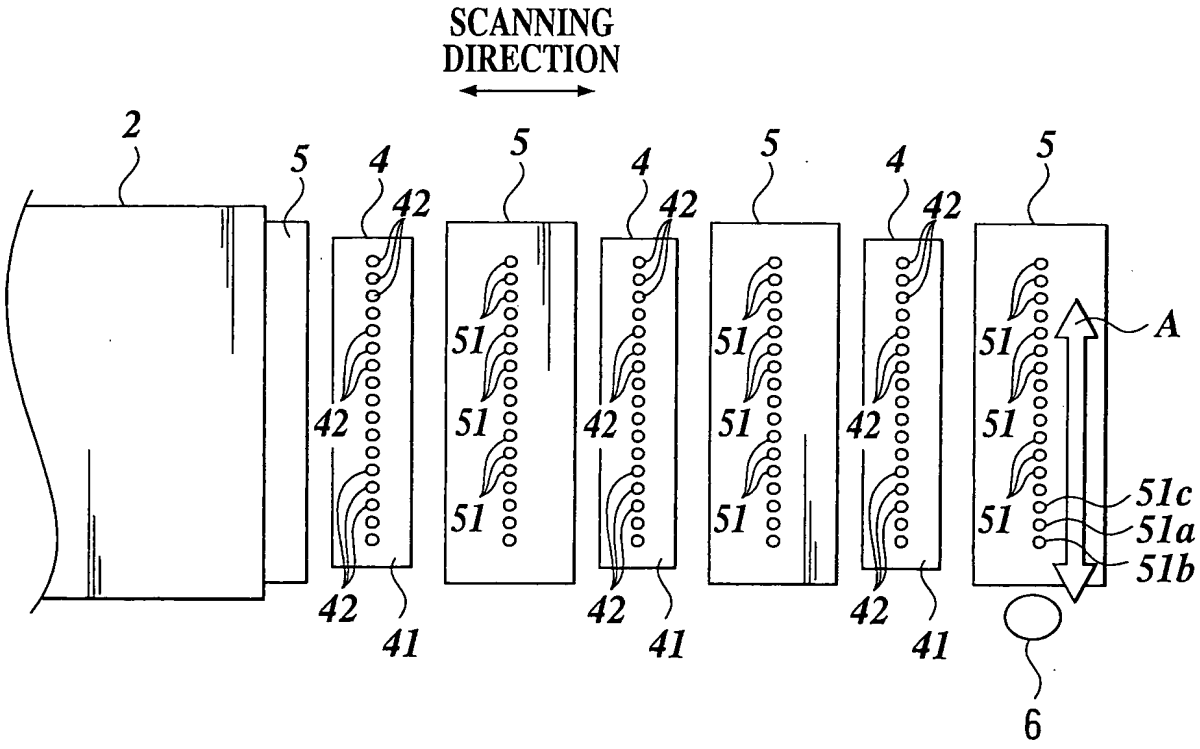
[MEANS FOR SOLUTION] An ink jet recording apparatus comprises: a recording head for jetting a photo curable ink to a recording medium from a plurality of jet openings arranged in row; a plurality of light source for irradiating light to cure an ink jetted from the recording head; a light quantity measuring sensor for measuring a light quantity of each light source; a memory section for storing a desired value of light quantity of the light source; and a control section for controlling the light quantity of the light source according to a measured value by the light quantity measuring section and the desired value of light quantity of the light source stored in the memory section. In case at least one of the measured value of the light source is less than a desired value of the light source, the control section increases a light quantity of another light source which is different from the light source.

[SELECTED FIGURE] FIG. 4

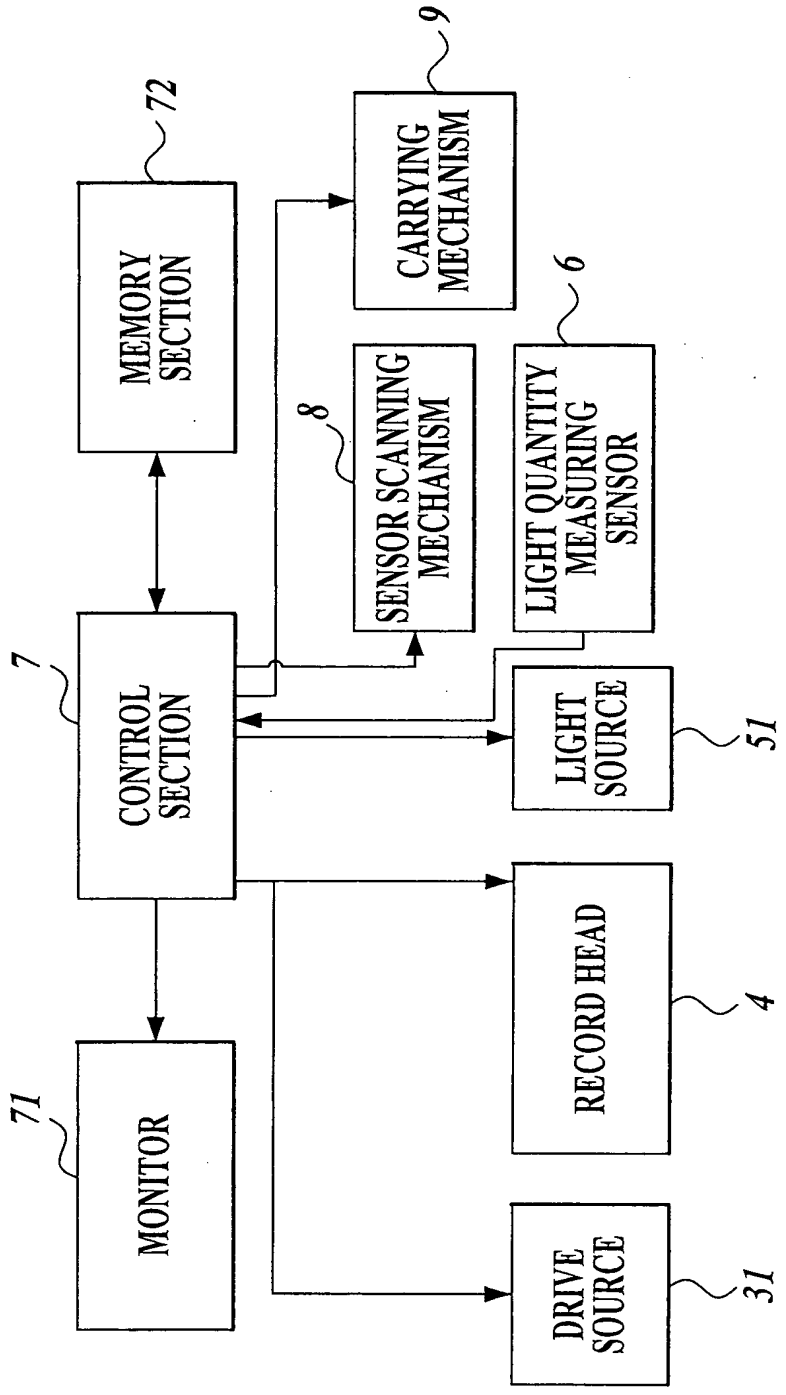
[FIG. 1]


SCANNING
DIRECTION
5
5
3
Y
M
C
K
5
2
6
4
4

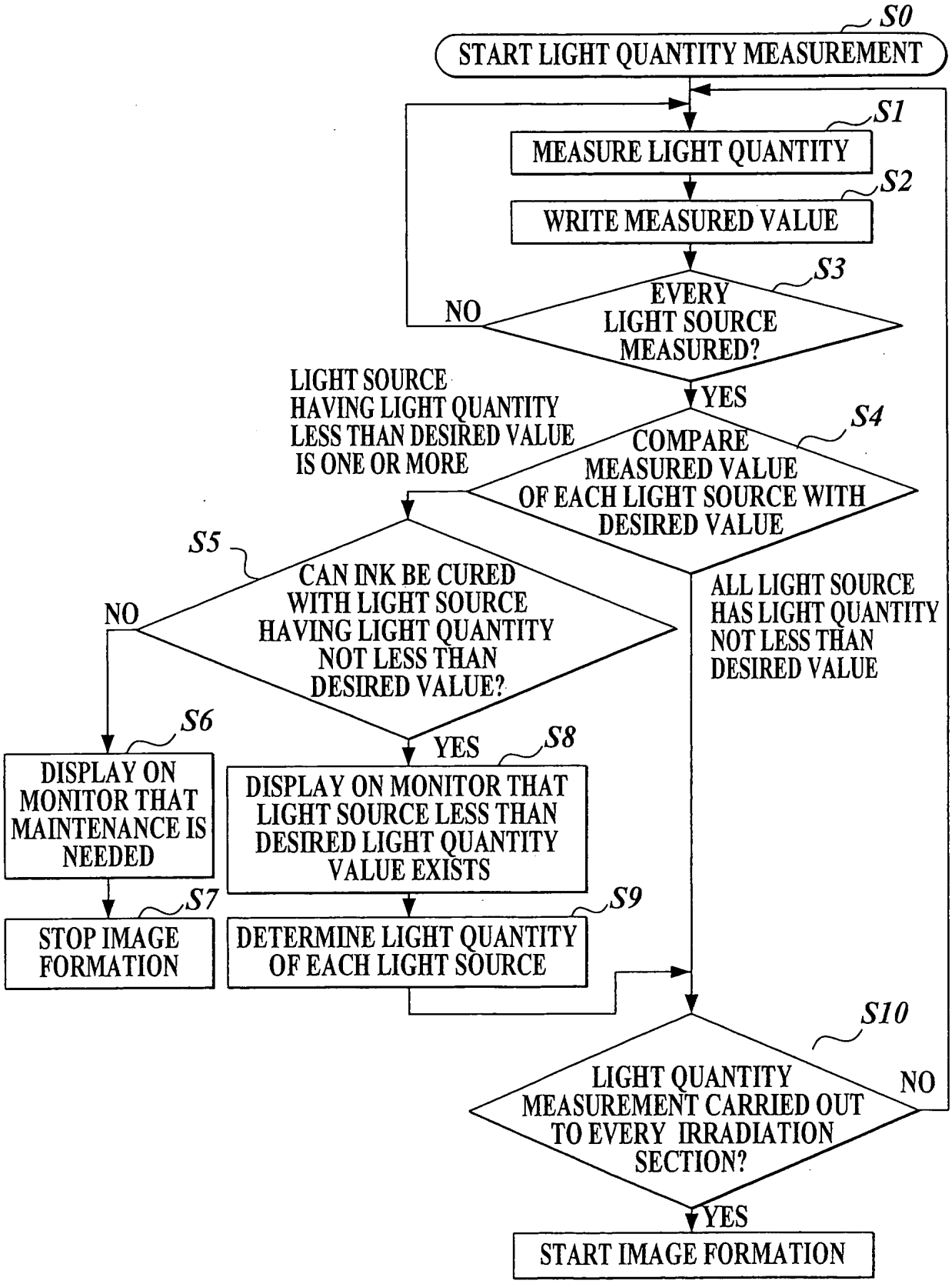
[FIG. 2]


SCANNING
DIRECTION
2
5
4
42
5
4
42
5
4
42
5
51
51
51
42
42
42
42
51
51
51
51
51
51
A
51c
51a
51b
42
42
42
41
41
41
6

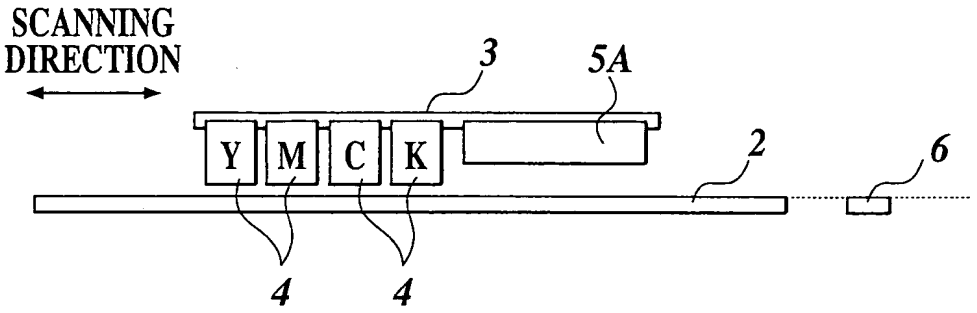
[FIG. 3]


MEMORY SECTION
72
CARRYING MECHANISM
9
SENSOR SCANNING MECHANISM
8
LIGHT QUANTITY MEASURING SENSOR
6
CONTROL SECTION
7
LIGHT SOURCE
51
RECORD HEAD
4
MONITOR
71
DRIVE SOURCE
31

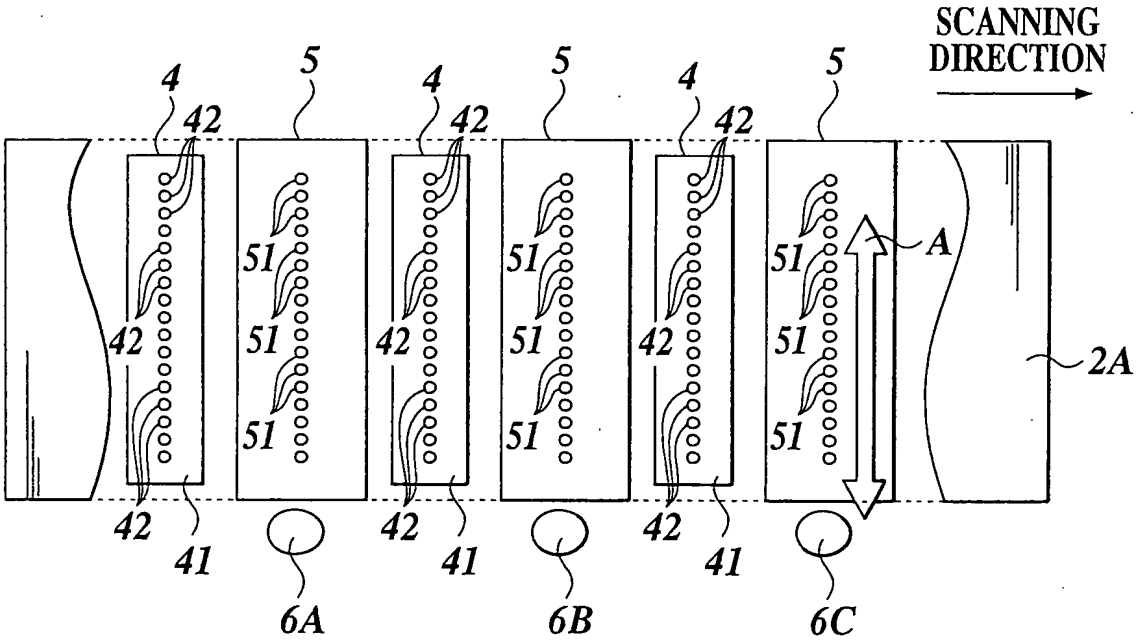
[FIG. 4]


S0
START LIGHT QUANTITY MEASUREMENT
S1
MEASURE LIGHT QUANTITY
S2
WRITE MEASURED VALUE
S3
EVERY LIGHT SOURCE MEASURED?
NO
YES
LIGHT SOURCE HAVING LIGHT QUANTITY LESS THAN DESIRED VALUE IS ONE OR MORE
S4
COMPARE MEASURED VALUE OF EACH LIGHT SOURCE WITH DESIRED VALUE
ALL LIGHT SOURCE HAS LIGHT QUANTITY NOT LESS THAN DESIRED VALUE
S5
CAN INK BE CURED WITH LIGHT SOURCE HAVING LIGHT QUANTITY NOT LESS THAN DESIRED VALUE?
NO
YES
S6
DISPLAY ON MONITOR THAT MAINTENANCE IS NEEDED
S8
DISPLAY ON MONITOR THAT LIGHT SOURCE LESS THAN DESIRED LIGHT QUANTITY VALUE EXISTS
S7
STOP IMAGE FORMATION
S9
DETERMINE LIGHT QUANTITY OF EACH LIGHT SOURCE
S10
LIGHT QUANTITY MEASUREMENT CARRIED OUT TO EVERY IRRADIATION SECTION?
NO
YES
START IMAGE FORMATION

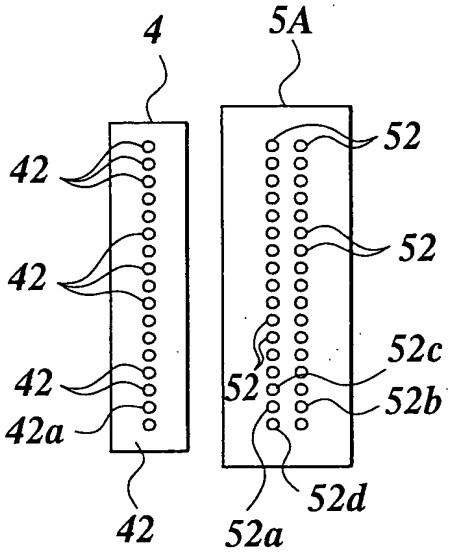
[FIG. 5]


SCANNING
DIRECTION
3
5A
Y
M
C
K
2
6
4
4

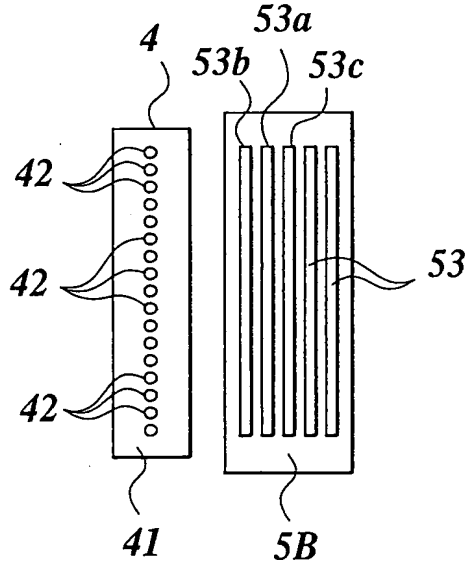
[FIG. 6]


SCANNING
DIRECTION
4
42
5
51
A
2A
41
6A
6B
6C

[FIG. 7]


4
5A
42
42
42
42a
42
52
52
52c
52
52b
52d
52a

[FIG. 8]


4
53a
53b
53c
42
42
42
53
41
5B